

## SERBIA – PART OF THE SOUTH ZONE OF THE RANGE OF DISTRIBUTION OF THE EUROPEAN GRAYLING (*THYMALLUS THYMALLUS* L.)

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**Abstract** – The grayling (*Thymallus thymallus* L.) inhabits only a small number of hill-mountain rivers in Serbia. All these rivers belong to the Danube river basin. The Republic of Serbia represents a part of the southern zone of this fish species' range of distribution in Europe. The eastern, southwestern and western zones of the grayling's range of distribution have been determined. During the second half of the 20<sup>th</sup> century, a decline in the number of its populations has been observed, primarily because of the construction of hydroenergetic objects, intensified fishing and inadequate protection. This can result in a shift in the grayling limits of distribution range in South Europe.

**Key words:** Grayling, (*Thymallus thymallus* L.), distribution zones, Serbia, imperilment, protection.

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### INTRODUCTION

The grayling (*Thymallus thymallus* L.) is a rare fish species in Serbia. Its range of distribution is limited to only a few regions. Together with brown trout, the grayling mainly inhabits the middle river flows of the hill-mountain rivers which belong to the Danube river basin. It is seldom found in the lower river flows, e.g. in Studenica river.

Due to its exceptional appearance (a large colored dorsal fin, violet stripe along its back, large scales, “dignified” movements), the grayling has been called the “knight” of mountain rivers\*, or even more picturesquely, a “coral” in the upper river flow of the Tara (Djilas, 2005).

In the region of ex-Yugoslavia, the distribution range of the grayling is larger (hill-mountain tributaries of the Sava, river basin of the Danube; Soča river, Adriatic Sea confluence). The Luča river, together with the Plav lake is considered to be the most southerly region of grayling distribution range in Europe (Janković, 1960).

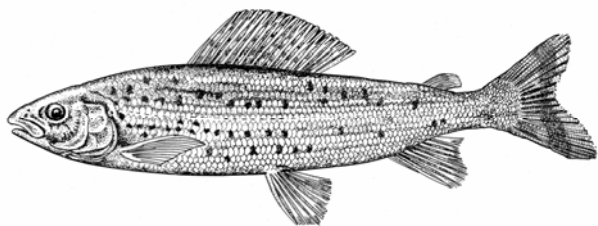
During the 20<sup>th</sup> century, very extensive studies on the range of distribution, taxonomy

and ecology of the grayling have been undertaken and the specificities of this fish species inhabiting the Soča river (Slovenia) were underlined (Taler, 1944, 1956; Aganović, 1952; Janković, 1960, 1964, 1965; Šenk, 1953, 1956, 1957). Also, rigorous protection measures based on detailed ecological and histological studies have been proposed (Janković, 1960) which, however, have been neither accepted nor realized.

The first artificial spawning of the grayling was performed in 1939 (Apostolski, 1978). In the Bohinj Lake, Slovenia, a spawning spot and upbringing place of this species fingerling have been constructed.

### MATERIALS AND METHODS

Within the scope of faunistic and ecological research projects of the Institute for Biological Research “Siniša Stanković”, Belgrade and Serbian Academy of Sciences and Arts, performed during the second part of the 20<sup>th</sup> century, the range of distribution of grayling (*Thymallus thymallus* L.) in the Republic of Serbia was established. Endangerment of this fish species has been continually studied up to the present.



**Figure 1.** A grayling (*Thymallus thymallus* L.) specimen from Serbia.

The specimens were caught at defined profiles of the examined rivers from one to another river bank using professional fishnets and fishhook gears employed in sport fishing. Soon after that electrofishing equipment was applied.

In order to obtain full information on river fish stocks, catch and possible measures of protection, the data of sport fishing organizations of the examined regions and The Basic Plans for Development of Fishing (official documents) were used.

## RESULTS AND DISCUSSION

On the basis of the results obtained to date, there are three zones of the grayling range of distribution in the Republic of Serbia:

**I. East zone:** The Radovanska Reka river, left tributary of the Crni Timok and Resava, right tributary of the Velika Morava river;

**II. Southwest zone:** The Ibar river with its left tributary Studenica (a tributary of the Zapadna Morava) and the Uvac with its left tributary Vapa river and their tributaries, as well as the Lim river tributaries, and

**III. West zone:** The Drina river with its tributaries Jadar and Rzav, tributaries of the Sava.

**Zone I.** The grayling region of the Radovanska river is relatively close to that of the Resava river. In August 1982, in the middle river flow of the

Radovanska Reka river, three specimens of grayling were caught. Earlier investigation (Filipović and Janković, 1978; Janković, 1980), as well as those performed after 1982 did not provide positive results.

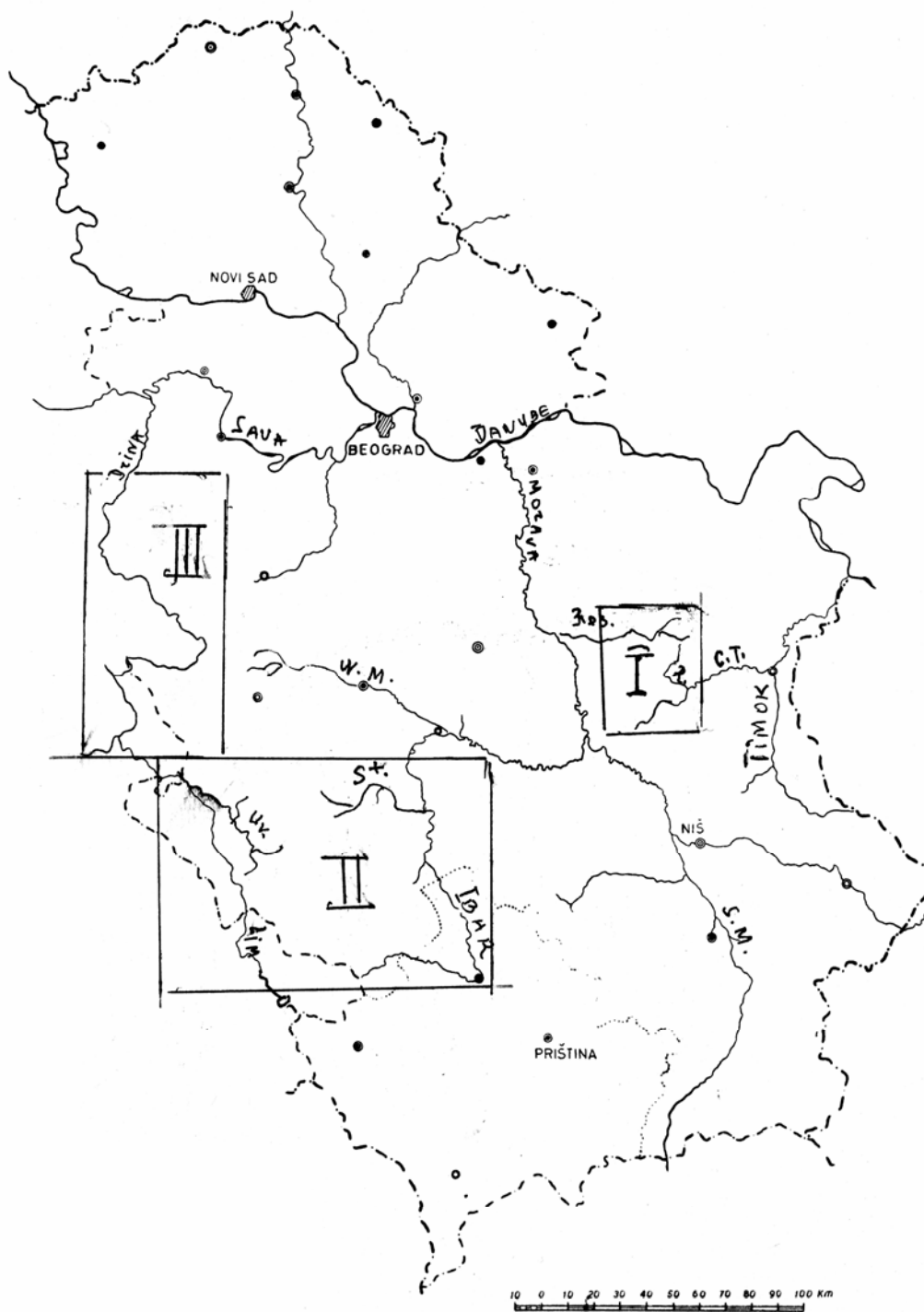
According to the information obtained from the Sport Fishing Organization in the town of Svilajnac, fingerlings from Slovenia were used to stock the Resava river with graylings which have successfully adapted, mainly inhabiting the river section upstream of the Vodno settlement. In 1979, during the course of complex limnological investigations of the Resava river, the presence of grayling was not recorded (Grubić et al., 1982).

It could be only hypothesized that the grayling population inhabiting the Radovanska Reka river appeared after this fish stocking in 1970s.

**Zone II.** Before construction of the “Gazivoda” hydroenergy plant, the upper river flow of the Ibar was rich with grayling. After construction of the above-mentioned hydroenergetic system and the formation of the reservoir on the Ibar, grayling abundance abruptly declined and at present only individual specimens of this fish species can be found. In 1997, a 40 cm-long grayling specimen weighing 700 g was caught and this encouraged sport fishermen, suggesting that this fish species was maintained under altered environmental conditions (Andjelković, 1998).

The Studenica, a left tributary of the Ibar, used to represent a river that was extremely rich with salmonids (brown trout, grayling). Due to road engineering along the river flow, the penetration of cyprinid fish species from the contaminated Ibar river into the Studenica, intensified sport fishing and revitalization of erosion processes in this river basin, populations of these fish are declining (Janković, 1965).

The upper river flow of the Uvac with its tributary, the Vapa, and their tributaries (the Sjenica-Pešter Plateau) represents an exceptional salmonid region of the Republic of Serbia (brown



**Figure 2.** Zones of grayling (*Thymallus thymallus* L.) distribution in Serbia.

trout, grayling and Danube salmon). Construction of the hydroenergetic systems “Bistrica”, “Kokin Brod” and “Sjenica” along the entire river flow of the Uvac led to the changes in the regime of water flow rate and temperature and made migration of these fish species impossible. Also, more intense fishing, in spite of the interventions of sport fishing organizations accompanied by the introduction of new fish species into the newly-formed “Uvac” reservoir resulted in the reduction of brown trout, grayling and Danube salmon numbers.

According to Ranković (1973), the grayling inhabits the Uvac at areas with deeper waters and larger river width. The results of our investigations performed during 1954, 1973 and 1978, using fish nets, hooks and an electrofishing apparatus demonstrated grayling presence in the Uvac and its tributary Vapa. In October, 1978, grayling made up 33.33% of the total number of fish caught in the Uvac and only 9.8% of fish caught in the Vapa (Janković, 1979, 1983). Grayling settlement downstream of the above-mentioned reservoirs depends on fish migration from the Lim, as well as on fishing intensity.

**Zone III.** The Drina and its tributaries represent bordering waters of Serbia, Republic Srpska and Montenegro. During the 1950s, the Piva and Tara rivers which form the Drina, as well as the Drina and its tributaries, were very rich with grayling. Construction of the “Piva” hydroenergetic system on the Piva river, resulted in a conspicuous reduction of grayling population. According to the results of our investigations performed during this period, the Drina was rich with grayling up to the Ustikolina settlement. Moving from Ustikolina to the village of Ustiprača, the presence of the grayling was more seldom recorded. The rivers Sutjeska, Bistrica, Čehotina, Prača and Lim, all of them tributaries of the Drina, are also significant grayling rivers. Grayling inhabits the whole river flow of the Lim which emerges from the Plav Lake (Janković, 1960).

According to the results of Taler (1944), graylings also occur in the Jadar and Drinjača



Figure 3. Photograph of the Uvac river canyon.

rivers, tributaries of the Drina. Based on the data of sport fishing organizations, graylings can be found at present in the Rzav, a tributary of the Drina (region of the Republic of Serbia).

Considering the present zonal range of grayling distribution, it can be assumed that it was different in the past. This rather sensitive fish species will gradually disappear from the rivers, especially those exposed to mine dross pollution. For example, in East Serbia, the Rtanj and Bogovina mines are situated in the vicinity of the Crni Timok river, and the Senjski Rudnik mine by the Resava river. These mines were polluting these rivers with dross and in addition, explosives were used for illegal fishing. Parts of both the upper and middle river flow of the Ibar were, and are still, exposed not only to pollution from nearby mines, but also to illegal

fishing. The consequences of these influences are evident. The grayling remained preserved in the Studenica, a tributary of the Ibar river.

The conclusion that the Studenica river was preserved because of its inaccessibility, as well as due to the Nemanjić dynasty, who built the Studenica monastery and the "St. Sava" ascetic cell in 12<sup>th</sup> century close to this river, seems unlikely. The monks and the inhabitants of this region were protecting not only these Serbian holy objects but also the Studenica river itself. At present, these values that are of great significance to Serbia are protected by international (UNESCO) and national (The Institute for Nature Protection) legal regulations.

While the east zone cannot be considered as a zone of autochthonous grayling from the Danube river basin because of possible introduction of fish fingerling from the Soča river (Adriatic Sea confluence), zones II and III are the zones of autochthonous grayling. The rivers of these zones, with the exception of the Ibar and its tributary Studenica river, represent a unique hydrographic net of the Drina river basin.

The Studenica river, the Uvac with its tributary Vapa river and the Drina with its tributaries, are the grayling propagation centers in the Republic of Serbia. It should be emphasized that besides the Studenica river (Serbia), the Luča river with the Plav Lake and the Lim river, as well as the Tara river (Montenegro) represent the main »original« habitats of grayling for the river basins of the Ibar and the Drina. The significance of these habitats is even more remarkable taking into account the fact that some of these rivers represent bordering waters of the Republic of Serbia, the Republic Srpska and Montenegro.

By The Decree on the Protection of Natural Rarities, in 1993 the grayling was declared a protected fish species in Serbia and its fishing was prohibited. It is necessary to bring into accord national law on fishing with the above decree. As early as 1960, strict measures of grayling protection

in Yugoslavia were proposed which included the prohibition of its fishing during the spawning period, *i.e.* from March 1st to June 1st and the fishing of specimens under 40 cm in length in order to protect spawning populations. In addition, a complete prohibition of grayling fishing in the Studenica and the Uvac rivers, considered to be of great significance for grayling protection in Serbia, was proposed (Janković, 1960).

The proposed construction of three new hydroelectric power stations ("Buk Bijela", "Foča" and "Paunce") on the "upper Drina" in the future (cooperation of the Republic of Serbia and the Republic Srpska) (Palević, 2009), while enabling the exploitation of the energy potential of the Drina, would endanger the region of the Drina, the Piva and the Tara and their tributaries which are characterized by extraordinary natural beauties and are significant from faunistic point of view. The canyon of the Tara has been protected by UNESCO regulations. In the case of realization of the above plan, the aquatic ecosystems, and especially ichthyofauna, will be subjected to great changes. A fourth hydroelectric power station, "Sutjeska", the construction of which is planned to begin later, would greatly contribute to a further deterioration of the entire ecosystem of the Drina river basin.

If the above-mentioned plans are realized, in spite of the warnings of ecologists from Serbia and Montenegro (Savić, 1984), and the UNESCO decision, it will be of the utmost importance to perform complex studies on the changes to be expected in the future and their consequences on the entire ecosystem of the Drina river basin and its surroundings. At the same time, a project related to alleviating these consequences should be prepared, primarily a project for the construction of spawning spots for brown trout (*Salmo trutta* L.), grayling (*Thymallus thymallus* L.) and Danube salmon (*Hucho hucho* L.). The expenses of these studies and projects, as well as of the maintenance of objects and application of measures for alleviating the consequences of hydroelectric power-station activities must be included in the foreseen cost of constructing the first hydroenergetic system "Buk

Bijela". This proposition should become a legal obligation for all future projects on the waters in Serbia and on bordering rivers.

It can be assumed that these and additional measures will at least partially alleviate the consequences hydro engineering could have on the aquatic ecosystems of the Piva and Tara rivers which form the Drina, the Drina itself and its tributaries, as well as on the extremely beautiful and valuable Tara Canyon.

### CONCLUSIONS

The European grayling (*Thymallus thymallus* L.) inhabits only a few hill-mountain rivers in Serbia, all of them belonging to the Danube river basin.

Three zones of grayling distribution in Serbia have been established. Different from the first zone, the second and the third zone can be considered to represent autochthonous habitats of the grayling. With the exception of the Ibar river and its tributary the Studenica, these zones are a unique hydrographic region of the Drina river basin.

During the second part of the 20<sup>th</sup> century a decline in the number of grayling populations in Serbia was recorded. The proposed rigorous measures of protection have never been realized.

Endangerment of grayling populations results from intensive hydro engineering, irrational forest exploitation, revitalized erosion processes, road engineering activities along the rivers, intensified sport fishing and water quality deterioration of the main river systems which lead to the penetration of cyprinid and other fish species into hill-mountain rivers.

In 1993, the grayling was declared a protected fish species and its catching was prohibited by The Law Regulations on the Protection of Natural Wealth in Serbia. The Law on Fisheries should be brought into accord with this document.

The Studenica, a tributary of the Ibar, the Uvac river with the Vapa, a tributary of the Lim and the Drina with its tributaries represent the centers of grayling propagation.

In the case of the construction of the four planned hydroenergy plants in the region of the "upper Drina" (agreement of the Republic of Serbia and the Republic Srpska), it would be imperative to perform complex ecological studies on the changes to be expected in both terrestrial and aquatic ecosystems of the Drina, the Piva and the Tara which form the Drina, their tributaries and surroundings. The expected changes in the Tara river canyon are of special significance because this canyon was protected by UNESCO decree.

It is necessary to prepare spawning spots for brown trout, grayling and Danube salmon. The cost of these studies and spawning spots, as well as the expenses of their maintenance, have to be incorporated into the total sum of the costs for the construction of the first hydroelectric power station »Buk Bijela«. Such an approach to ecological problems should become legal obligation for all future activities on the waters of Serbia.

A shift of the southern border of the grayling range of distribution in Europe is to be expected if strict measures of protection of this fish species in Serbia are not applied. These investigations are significant for biodiversity protection of the Republic of Serbia and Europe.

*Acknowledgement* – In memory of Dr. Dušica Stefanović, the first woman ichthyologist in Serbia, executed in the "Banjica" Camp by a firing squad in 1941. Her pioneering ichthyologic studies on Lake Ohrid salmonid fish inspired future generations of ichthyologists.

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## СРБИЈА – ДЕО ЈУЖНЕ ЗОНЕ РАСПРОСТРАЊЕЊА ЕВРОПСКОГ ЛИПЉЕНА (*THYMALLUS THYMALLUS* L.)

ДРАГА ЈАНКОВИЋ

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Европски липљен (*Thymallus thymallus* L.) насељава само мали број брдско-планинских река у Србији. Све припадају сливу Дунава. Србија је део јужне зоне распрострањења ове врсте риба у Европи. Утврђене су три зоне распрострањења липљена: источна, југозападна и

западна. У другој половини 20-ог века запажено је опадање бројности његових популација. Узрок томе је пре свега изградња хидроенергетских објеката, појачан излов и неадекватна заштита. Све то може довести до померања јужне границе његовог распрострањења у Европи.